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ABSTRACT

With the advent of constructivist oriented instruction in learning institutions comes an enormous challenge, that of structuring individual-centered learning within a community of learners. Within this instructional framework, struggles to satisfy both individual and group learning needs can lead to one canceling the other out. Tendencies towards either individual-centered or collaborative learning depend largely on the Constructivist stance adopted (Cunningham, 1991, Garrison, 1998; Jonassen, 1991, 1995; Lave & Wenger, 1991; Vygotsky, 1987). This ongoing struggle represents the paradox of Constructivist instruction; however, there is an alternative. This exploratory paper utilizes assumption from Internal Realism (Putnum, 1991, 1994), draws from advances in cybernetic science (Maturana & Varela, 1980; Varela, 1981), and communications theory (Habermas, 1990; Krippendorff, 1994) to make the case that underlying biological and communicative structuring play an important constitutive role in multiple levels of meaning construction (biological, psychological, social) that are implicated in learning processes. The extent to which knowledge of underlying structures can inform on learning processes is addressed and recommendations are made for adopting Communicative Constructivist Perspective (CCP) as a potential educational reform tool for increasing awareness of instruction that may detract from efforts to achieve sustainable learning within a community of learners. (Contains 60 references.) (Author/AEF)

THE PARADOX OF CONSTRUCTIVIST INSTRUCTION: A COMMUNICATIVE CONSTRUCTIVIST PERSPECTIVE

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Abstract

With the advent of Constructivist oriented instruction in learning institutions comes an enormous challenge, that of structuring individual-centered learning within a community of learners. Within this instructional framework, struggles to satisfy both individual and group learning needs can lead to one canceling the other out. Tendencies towards either individual-centered or collaborative learning depend largely on the Constructivist stance adopted (Cunningham, 1991, Garrison, 1998; Jonassen, 1991, 1995; Lave & Wenger, 1991; Vygotsky, 1987). This ongoing struggle represents the paradox of Constructivist instruction; however, there is an alternative. This exploratory paper tilizes assumption from Internal Realism (Putnum, 1991, 1994) draws from advances in cybernetic science (Maturana & Varela, 1980; Varela, 1981) and communications theory (Habermas, 1990; Krippendorff,1994) to make the case that underlying biological and communicative structuring play an important constitutive role in multiple levels of meaning construction (biological, psychological, social) that are implicated in learning processes. The extent to which knowledge of underlying structures can inform on learning processes is addressed and recommendations are made for adopting Communicative Constructivist Perspective (CCP) as a potential educational reform tool for increasing awareness of instruction that may detract from efforts to achieve sustainable learning within a community of learners.

I. Assumption

This exploratory paper revolves around a conceptualization of the subject-object distinction held by a variation of realist philosophy that emphasizes the importance of human practices. This position is commonly referred to as 'internal realism.' Internal realists take into consideration scientific and everyday practices while utilizing subject-object conceptual distinctions to deal with conflicting knowledge claims in order to achieve rational consensus in a changing world (Putnam, 1994).

II. Defining subject-object conceptual distinctions

Why is it important to educational research and instructional design to address philosophical issues such as subjectivity and objectivity? Eisner & Peskin (1990) provide this answer: Thoughts have consequences: how we think about subjectivity and objectivity affects research procedure because these issues are typically embedded in the broader framework, abeit most often implicitly, that directs the conduct of our inquiry (p. 15).

Careful attention must be given when discussing the notion of objectivity and subject-object distinctions, since the terms can have strikingly different connotations depending on how they are being used and to what they refer. The subject-object distinction has ontological, epistemological, and methodological defining levels, along with relations between these defining levels. The ontological level deals with assumptions of what is known or knowable about reality and its nature. The epistemological level address the relationship between the knower and the known where assumptions concerning this relation depend largely on the ontological features supported. The methodological level deals with how one goes about finding things out, the process of which depends largely on ontological and epistemological features supported (Guba, 1990).

The internal realist position utilizes a specific formulation of the subject-object distinction which respect to the features at each level of the subject-object distinction described. First, in terms of ontology,

there is no truth claim to any absolute knowledge that subjects have of objects in the world as the Postpositivist/Realist position holds Instead, objectivity becomes a regulative ideal. Popper's (1968) states:

The status of truth in the objective sense , as correspondence to the facts and its role as a regulative principle, may be compared that of a mountain peak, which is permanently, or almost permanently, wrapped in clouds. The climber may not merely have difficulty getting there , because he may be unable to distinguish, in the clouds, between the main summit and some subsidiary peak. Yet this does not affect the objective existence of the summit. . .The very idea of error, or of doubt. . implies the idea of an objective truth, which we may fail to reach (p. 226).

Under Popper's reading of science, what is considered to be objectively true extends beyond what is empirically found and with it scientific inquiry entails more than compiling an inventory of cold hard empirical facts. This interpretation of the fundamental aims of science relocates the focus of objective truth from objective facts to a larger landscape of scientific inquiry more congruent with the extensive range of possible human experience under investigation.

This has an important consequence for education's use of scientific methodology. It suggests what we already know to be true, there is a lot more going on in the realm of experience at any given time than scientific inquiry is able to discern and that trying to maintain an awareness of the expansive landscape of experience leaves the door open to discovering new things in the study of learning processes that are continually immerging in lives. Closing the door on what is not immediately distinguishable is the mark of an impatient scientist

Second, in terms of epistemological features, the denial of the conceptual independence of subject and object is not a denial of the possibility of human subjects achieving true knowledge about what is objectively there in actuality. Putnam (1987) states, "Kant's glory in my eyes, is to say that the very fact that we cannot separate our own conceptual contribution from what is 'objectively there' is not a disaster." The fact that individuals' experiences take place in the world and within social/cultural communities does not in any way detract from the actual distinction that exists between the subject experiencing and the object experienced.

Third, in terms of methodological features, the individuals' within society constitute a community of critical inquirers. Popper expresses this well when describing the critical spirit of objectivity applied to science: The objectivity of science is not a matter of the individual scientists but rather the social result of their mutual criticism, of the friendly-hostile division of labour among scientists, of their co-operation and also of their competition. For this reason, it depends in part, upon a number of social and political circumstances which criticism possible. (p. 95).

The subject-object conceptual position of the internal realist is to be distinguished from one commonly discussed within the area of Constructivist instruction. In the case of Constructivist instructional theory, most Constructivists accept only one subject-object distinction, that which is part of an epistemological belief system within the subject's experience . Constructivists generally oppose making the ontological subject-object distinction, interpreting this view as being part of an Objectivist stance, to be distinguished from an Constructivist view which does not commit to such a claim (Guba, 1990; Jonassen, 1991). To illustrate:

Table 1: Positions on subject-object conceptual distinctions

Domain	Postpositivism	Constructivism	Alternative
Ontology	Realist *	Relativist	Internal realist *
Epistemology	Objective *	Consensual/subjective *	Critical perspective *
Methodology	Verificatory	Hermeneutical reconstructive,	Rational Communication *

* upholds subject-object distinction

Upholding a commitment to ontological, epistemological, and methodological varieties of the object-subject distinction establishes a standard that Constructivist instructional theories have tended to conflate (Bopry, 1999; Cunningham, 1991; Cobb & Yackel, 1996; Jonassen, 1991).

III. What Constructivism in education is not

Constructivism is not a type of learning, nor is it a teaching methodology. It is not to be taken as some learning strategy that can be applied one day in a specific context and then forgotten. Rather, Constructivism can be categorized as a philosophy of learning that refers to how individuals learn all the time. That is, individuals constantly construct their learning, whether they are actively pursuing some form of discovery learning or sitting in a classroom taking notes.

However, there are different types of learning construction (Clemens, 1997; Devries & Zan, 1996; Johnson, 1998) for different levels of meaning construction (Bunge; 1979, Gabora, 1997, Luhman, 1986). Some learning processes will be more individually centered and some more group oriented. In addition, not all learning processes will occur at the same level of individual awareness or self-consciousness (Damasio, 1999; Dennett, 1991). There is no one way that has succeeded in explaining the many types of learning constructions adequate to provide a comprehensive picture the Constructivist learning taking place.

IV. Statement of problem

It is argued that the conflation of the ontological subject-object conceptual distinction has narrowed the range of what the epistemological and methodological subject-object conceptual distinctions refers. It is this narrowing of the range of inquiry that is believed responsible for conflicts in how instructional designers conceptualize group and individual oriented instruction , giving rise to an ongoing struggle referred to here as the paradox of Constructivist instruction.

V. Objectives

The paper draws on contemporary work in neuroscience, cybernetics, communications theory, and philosophy of science in order to develop a Communicative Constructivist Perspective (CCP) within a framework that suggests the complementarity and parellel duality (independent yet integrated) of Constructivist learning processes and knowledge.

VI. Constructivist learning processes

One way to view the Constructivist learning is to describe it in terms of processes that make it up and that vary in level of conscious awareness. This is an important component of Constructivist instruction in that research on learning processes informs on instructional design. What is striking in the Constructivist literature is how different the range of explanations for learning processes can be as a function of the Constructivist position held.

i. Meta-cognitive, cognitive, motivational and affective processes

Breadth and depth of self-system processes are demonstrated in basic psychological processes identified in cognitive psychology. Meta-cognition refers to the monitoring and controlling of cognition (Zimmerman, Bandura, Martinez-Pons, 1992). This is typically differentiated from regular cognitive processes. Cognitive processes refer to those mental operations required to encode and retrieve information. Wolters (1998) views cognitive processes as goal oriented, strategic, and attentional. Motivational processes refer to the underlying drive or desire towards something. Motivation al processes are associated with the directing of effort towards some goal, either intrinsically or extrinsically determined. Affective processes are distinguished from cognitive, meta-cognitive, and motivational processes. Affect has been used to refer to feeling states, moods, and emotional experiences (Newman, 1994).

In contrast to motivational states, affective processes often tend to be more diffuse and sometimes without any specific direction or focus. The diffuseness of certain psychological processes (i.e., feeling, emotion) have made it difficult for cognitive psychology to explain. This is due to the fact that affective processes are largely co-determined processes within the self-system independent of self-consciousness, making these processes difficult for individuals to grasp.

ii. Individual Constructivism and volitional processes

Different views on how to treat intentional and collaborative learning have Views of the self (I) as a substantive category began with the Cartesian theory (Descartes, 1641). While the view was greatly criticized throughout modern philosophy, substantive notions of the self continue to flourish. McCombs & Marzano (1990) view the personal self-structure as the generative structure for self-processes. They state, "To generate the will for self-regulation, students must realize that they are creative agents, responsible for and capable of achieving self-development and self-determination goals, and they must appreciate and understand their capabilities for reaching these goals." This gets at the importance of individual 'self-directedness' quality of learning.

Von Glaserfeld (1995) labels volitional processes as an individual's 'mapping of actions and conceptual operations that had proven viable in the subject's experience. Deci, Ryan, & Koestner's (1999) theory of self-determination is concerned with the degree to which individuals experience their mental processes to be freely chosen rather than being coerced by desired outcomes. They distinguish self-determination from external determination by the extent to which individuals believe they have causal control. At this level, self-determining processes are connected to the concept of "self." Such processes take place at the level of self-consciousness, but there are other processes that cannot be explained within the framework of the "self" concept. This is the case for different levels of processes where self-consciousness does not accompany the processes taking place.

iii. Social Constructivism and social processes

Social processes have also been implicated in the determination of constructivist learning. Much of the work in this area is referred to as social Constructivism, drawing its main theoretical basis from Vygotsky (1987), social activity theorists (Bordieu, 1976; Garrison, 1998; Lave & Wenger, 1991), and pragmatism (Rorty, 1978; Putnam, 1987). Garrison's (1996), approach emphasizes individual's self-realization being derived from actions in the social world. Social processes are largely embedded in a social context characterized by argument, discussion and debate.

Hare (1983) supports the position that individual processes are social in origin and create the various unities of personal identity (sense of personal identity, self-consciousness, agency). The ability to conceive of oneself as a unique singular being is a necessary precondition for the acquisition of a theory of self, experienced as one's sense of identity. Self-consciousness involves both knowing what one is experiencing (consciousness) and that one is experiencing it, which involves the capacity (concept of theoretical self) to be able to make some form of self-reference. Under this view the primary human reality of social processes is taken to be persons in conversation. Hare (1983) states, "The psychological secondary structure is a reflection of the primary structure, the array of persons and their conversation which is the primary reality of the society which brings them into being."

VII. Constructivist learning knowledge

Constructivist learning can also be described in terms of the knowledge structures and capacities attributed to it. Goldstein (1986) refers to knowledge as 'an organized body of knowledge usually of a factual or procedural nature, which, if applied makes adequate job performance possible.'

In this discussion on Constructivist Instruction, knowledge is used to refer to the mental facts, procedures, and strategies individuals rely on when making judgements and carrying out actions. This is to be distinguished from learning processes that refers to how individuals acquire knowledge and skills (Gordan, 1994). This distinction is important for two reasons. First, it maintains the dichotomizing strategy used throughout the paper. Knowledge is an object acquired by subjects through learning processes. Second, distinguishing knowledge from learning processes can allow for advances in understanding. Gordan (1994) states, 'By understanding something about the basic types of knowledge that

experts and novices use in performing tasks, we can enhance the processes involved in front end analysis, instructional system design , and program evaluation.'

Research studying the nature of knowledge and how it is acquired has given rise to various taxonomies being used to provide grounding for instructional program designs (Anderson, 1983; Gagne, 1985; Rasmussen, 1986). The taxonomy employed in this exploratory piece deals with the two types of knowledge traditionally associated with the notions of objectivity and use of subject-object conceptual distinctions, These are scientific knowledge and universal knowledge.

i. Universal knowledge

Rationalist philosophy has provided initial support for viewing human beings as possessing universal knowledge . Spinoza (1677) stated," Human reason begins in the same reason with its native powers and thus creates its first intellectual tools." Similarly, Piaget's (1954) cognitive development approach posited universal structures of knowledge (e.g. pre logical, concrete, abstract) or general categories that evolved with the biological organism (genetic epistemology).

Discourse on universal knowledge is not limited to individual rational principles but also includes communicative principles which govern all communicative exchange. Habermas'(1989)communicative approach to universal knowledge maintains its individual appeal to rationality while being at the same time deeply related to communicative exchange and has the potential to offer much to educational researchers interested in the theoretical bases of the relation between individual and social learning.

Habermas' Discourse Ethics (1989) seeks to imbed communicative knowledge within a dialectical framework, which acts as the moral determinate. He accomplishes this by treating human consciousness as that which is structured by language exchange within a normative structure of social interactions. Habermas' modified version of universal morality can be characterized by the following features:

1) Habermas advocates a communicative theory of meaning where validity and truth claims are decided by resolving normative rightness, which can be determined through discursive argumentation.

2) Habermas (1990), summarizes the generalized imperative that corresponds to his theory of argumentative discourse. He states, "All affected can accept the consequences and the side effects its general observance can be anticipated to have for the satisfaction of everyone's interests (and these consequences are preferred to those of known alternatives possibilities for regulation)."

3) The justification of Habermas' universal morality lies in accepting universality as a procedural principal of practical discourse. Habermas' notion of universality ('U') requires that each individual adopts the perspective of all others that are affected by the consequences of argumentative discourse. The types of questions that can be treated in such a manner are those that concern rightness and just regulation of social interactions involving all persons.

For Habermas, moral practices are social matters to be decided by discourse interactions of individually deliberating subjects. Thus, both individual will and community practices are taken into consideration by Habermas' universal theory of argumentative discourse. Habermas supports the causal role of socialization in shaping personal identity as well as the capacity of discourse to represent this.

ii. Scientific knowledge

The assumption at the beginning of this paper attributed to scientific inquiry the notion of objectivity construed as a regulative principle under the Internal Realist stance. Now the question becomes,what is the nature of scientific knowledge within the philosophical framework of Internal Realism? The following answer is provided.

At the level of basic neurophysiological organization there is multiplicity in function. The human brain and its respective components that underlie all cognitive function are not simply limited to specific functions. Edelman (1989) states, "There is no unique structure of combination of groups responsible to a given category or pattern of output. Instead, more than one combination of neuronal groups can yield a particular output , and a given single group can participate in more than one kind of signaling function." Even at the most rudimentary level of the human biological organisms, it is recognized that there is an interactive learning process taking place where some neuronal pathways are stimulated and strengthened with ongoing stimulation, whereas others are not. Dennett (1991) refers to this as the plasticity in nervous systems. This multi-function capacity could be used to help explain intercultural and interpersonal

differences reflected in individuals' learning styles with respect to the various backgrounds from which they evolve.

In addition to multi-functioning capacities,scientific knowledgehas been attributed a multi-perspective quality. Science-based knowledge is useful in providing leverage for multiple perspective explanations. Bohr's "complementarity theory" involves particles and waves while Aschby's "Law of Requisite Variety" provide strong support for the complementarity of multiple perspectives (Boyd & Zeman, 1995). The popularity of the Kuhnian notion of "paradigms" in historical scientific inquiry and recent scientific work attest to the recognition of multiple perspectives (Horwich, 1993). Assumptions of complementarity of perspectives pull together evolutionary, genetic, and rational perspectives on universal knowledge. This is an alternative to extreme positions which support either: 1) there being only one accurate description of reality possible (Scientific Realism) or, 2) there being no accurate description of reality possible (Postmodernism). This could prove useful in promoting interdisciplinary approaches to learning with a critical orientation.

Scientific knowledge informs on Constructivist instructional theory in multiple ways. First, knowledge gained from neurological research informs on how the brain structures work , how they develop, and how they can be changed (Edelman, 1992). This contributes by providing information concerning how the mind functions. Edelman (1992) states,"A description of mind cannot proceed liberally-that is, in the absence of a detailed biological description of the brain." It is a limitation that cognitive science has traditionally adopted a functionalist position defining the mind as being made up of mental representations that operate according to a set of definite procedures or computational functions that can be studied independently of underlying structure.

VIII. The struggle for a framework to accommodate Constructivist learning processes and knowledge

In order for a more complete grasp of learning to be achieved, there has to be some way to make intelligible all relevant knowledge structures and mental processes that constitute it. Markus & Wurf, (1987) insist on the need for the integration of the

complex set of intrapersonal (affect, cognition, motivation) and interpersonal (social perceptions, feedback from others) processes.

Efforts to describe learning processes involved in accessing knowledge have

resulted in the positing of various descriptions of mental processes and mental models. Johnson-Laird (1983) states, 'Mental models enable individuals to make inferences and predictions, to understand phenomena, to decide what action to take and to control its execution, and above all, to experience events by proxy (p. 397).' Understanding the relationship between knowledge taxonomies and corresponding mental models is a central part of instructional program design and its description. Therefore, the use of information technologies and communication theory in the following discussion addresses both functional and structural aspects.

Insights from neurological research recommend greater attention be paid to human functions that have been difficult to address by concentrating on psychological

processes alone (i.e., affect). Demonstrating the breadth and depth of processes requires a set of knowledge tools to get at those processes that fall beyond methodological approaches employed in cognitive psychology . Damasio (1998) supports there being both a biologically 'core consciousness' that is relatively stable across one's lifetime as well as an 'extended consciousness' with many levels and grades that produce an elaborate sense of self through lifelong individual processes. In this way, what counts as constructivist learning can be seen to extend beyond what individuals are consciously aware.

i. Contributions from Cybernetics

A recent turn in Constructivist instruction to the Cybernetic science offers new insights for instructional designers. Basic Cybernetic systems are organizing systems, operating by feedback mechanisms mediating from system outputs to subsequent system inputs. Bopry (1999) supports that this turn has the potential to provide Constructivist practitioners a 'philosophical mooring within the field itself.' Developments in this field have yielded numerous models of autonomous systems functions used to describe the operation of living and non-living systems (Varela, 1981). Basic autonomous systems can be characterized by four fundamental features: 1) organizational closure, 2) structural determination, 3) structural coupling, 4) proscriptive development.

Organizational closure refers to the organizing of the defining relations of a system necessary for the system to exist. Varela (1981) states "Organizational closure arises through the circular concatenation of processes to constitute an interdependent network." Without organizational closure, autonomous systems could not exist. In the game of chess, were it not that each chess piece had its respective operations on the chessboard, chess could not exist. Structural determination refers to the internal dynamics of autonomous systems responsible for structural change. Autonomous systems are limited by the interactions that its structure makes possible. Humans do not have the necessary wing structure to fly as do birds. However, human structural determination does allow for walking. Structural coupling refers to the interactions that autonomous systems have with the environment. Bopry (1999) states, "When a unity is in continuous interaction with the environment, so there is a mutual triggering of structural change over time that is stable in nature, the unity and the environment are said to be structurally coupled." Maturana & Varela (1987) support that structural coupling represents the basis for higher order cognitive development. Proscriptive development describes how it is that nature constrains living organisms during the process of evolutionary change. Varela (1991) states, "In a proscriptive context natural selection can be said to operate, but in a modified sense: selection discards what is not compatible with survival and reproduction."

Proscriptive functions are not limited to explanations of biological evolution. Bopry (1999) connects proscriptive development with culture and language use. Bunge's (1977) emergent level cybernetic theory and Boyd's (1993) cybersystemic theory provide explanations for multiple levels of emergent processes that include neurophysiological, autobiographical, and psycho-social processes.

Damasio's (1998) linking of conscious processes to neural architecture supports a general anatomy of consciousness.

Cybernetic's attention to the role of structure and organization in structural change runs concurrent with the underlying assumptions of this paper pertaining to subject-object conceptual distinctions. The subject-object conceptual distinction reappropriated as a Cybernetic structural-organizational conceptual distinction is supported by views of the commensurability of universal and scientific knowledge.

From an evolutionary perspective, a universal drive for self-preservation is recognized that binds individuals together in communicative collectives (Gould, 1986; Dawkins, 1973). Evolutionary theory supports the universal human drive to create (propagate) one's self (Darwin, 1871), one's genes (Dawkins, 1976), or one's mental representations or 'memes' (Blackmore, 1999). Cybernetics and evolution theory provide support for viewing human beings as possessing universal knowledge tools (Blackmore, 1999; Boyd & Zeman, 1993).

To take this one step further, Boyd (1993) supports the aesthetic critique as a universal knowledge tool. Advancements in aesthetic education have their biological origins in early attractiveness/repulsiveness experiences with the world. This basic level of biologically evolved perceptual engagement forms the basis of what later may develop into personalized and socialized preferences. Gabora (1997) supports that, in line with evolutionary theory, mental representations (or memes) evolve through adaptive exploration and transmission of information by way of variation and selection. This can be employed to explain the evolution of culture and creativity. Boyd & Zeman's (1993) notion of "generative concepts" is treated as a set of actively developing tools that function on a meta-level as principles for conceptual organization.

Cybernetics has the potential to make two important contributions to Constructivist Instrional theory. First, it gets at a depth of Constructivist learning that has been neglected in contemporary instructional design theory. This can be used to provide a basis for inquiry into a greater range of learning processes than has been considered in instructional theory. Second, there is also an important recognition of the genetic epistemological structures that have a causal role within the complex set of learning processes that instructional designers are interested in. The potential for the inclusion of science is quite attractive for instructional theories like Constructivist that do not provide obvious "self-correcting" mechanisms for interventions designed.

ii. Recursive communication

Krippendorff (1994) advances a recursive theory of communication based on assumptions of the self-referential quality of human communication. This approach to human communication focuses on the process of communicating as well as what is communicated. It puts forth the following propositions:
1) Human communication theory must also be about itself.
2) Everything said is communicated to someone understanding it as such.
3) Human communication constitutes itself in the recursive unfolding of communication constructions, held by participants (including of each other), into intertwining practices that these participants can recognize and explain in terms of being in communication.

This approach to human communication contains two defining features that are crucial to Constructivist Instructional design. First, it acknowledges self-referential quality of experience. Asserting that communication theory is about itself is to recognize that individuals experiences (even acts of theorizing about communication) are not products of the outside world but rather, are constructed from within the realm of one's own experiences. Krippendorff (1995) states,'Whatever gives rise to the awareness of something being said and communicated, the causes of ones experiences, must be located within one's horizon od understanding.' As such, individuals are responsible for constructing their own communication and the communication of others

Second, it recognizes the recursiveness of human experience. Individuals monitor their communications, transforming the consequences of actions into information thatrevises knowledge used to direct future actions. It maintains the necessary positioning of oneself within communications which includes other human beings and to attempt to understand others perspectives.

Together, Cybernetics and Recursive Communication Theory represent innovative approaches for the linking of Constructivist learning processes and knowledge under a complementary dualistic framework. Instead of conflating object-subject distinctions, this view suggests that it is possible to make

connections between complementary knowledge/structures and processes/functions that advance understanding. To illustrate:

Table 2: A complementary framework for Constructivist learning processes and knowledge Constructivist Learning Processes

Constructivist Learning	Processes -Knowledge	Constructivist Learning Knowledge
Individual Constructivism	Cybernetics	Scientific Knowledge
Social Constructivism	Recursive Communication	Universal Communicative Knowledge

The Communicative Constructivist Perspective (CCP) presented next takes the resolution of the Paradox of Constructivist instruction to be its primary focus. It does so largely by drawing together the theoretical strands discussed thus far.

IX. Communicative Constructivist Perspective (CCP): A multi-level, multi-perspective account

CCP is proposed to describe the breadth and depth of Constructivist learning experienced by individuals living within a community of learners. The first fundamental criterion concerns the importance of viewing meaning construction from multiple perspectives (aspects) and sharing these perspectives in such a way as to shape individual and collaborative learning. This gets at the need for both individual expression and collaborative communication where individual expressions occur and develop within individuals' sharing of subjective experiences.

In practical terms, students' learning experiences do not take place in isolation. Learning involves all individuals who partake in the ongoing communication and decision making together. This minimally includes, learners, parents, teachers, and administration coming together to express views in ongoing discussions.

The second fundamental criterion of CCP concerns employing definition of Constructivism that is broad enough to capture the multiplicity of knowledge structures (Boyd & Zeman, 1993; Cobb & Yackel, 1996; Edelman, 1989; Hare, 1983) at the various levels of meaning production (biological , psychological, social) that influence learning experiences. CCP addresses structural knowledge and self-systems processes that have been identified both outside and within Constructivist, Situated-Cognition, and Self-regulated learning literatures (Cobb, 1994; Yang, 1993; Zimmerman, Bandura, & Martinez-Pons, 1992).

In practical terms, learning is assumed to be multi-perspectual and therefore, requires flexible multi-level knowledge to be accommodated within higher-order learning activities in order to explain its complex nature within a community of learners. This is essential in interdisciplinary programs of educational instruction where students are exposed to a diverse range of educational content.

When designing education, it is important to recognize that what constitutes individual learners extends beyond psycho-social processes and our sense of self. In order to develop individual and collaborative learning, efforts should be directed at both the learner and the learning environment. For this reason, educational design requires theoretically grounded proscriptive and prescriptive necessary conditions. Utilizing a CCP for the purpose of educational design could result in adopting the following orientation:

Table 3: Key Postulates of the CCP Perspective

CCP Postulates	Description
Critical Orientation.	Not all subjectively constructed meaning will be equally accurate and it is an asset to be able to critically evaluate learning constructions.
Process and Identity Orientation.	Because this real world is subjectively experienced by each individual within a social realm, there is a dual need to develop one's own learning processes and personal/social identity.
Multiple-Perspectives	Many viewpoints or perspectives contribute to a more complete understanding which more closely approaches the truth.

Communicative Orientations	Constructivist learning often involves students, parents, teachers, and all other stakeholders.

This draws together much of the Constructivist learning mentioned already in an effort to apply it to individually meaningful collaborative learning process. Some of postulates (i.e., authentic and collaborative learning, decision making, communication skills development, etc.).

The CCP general orientation outlined could contribute to education applied to the design of interventions in order to modify the structuring and content of instruction in an effort to raise individuals' awareness of humans complex organisms amongst other complex organisms interconnected at various levels within the learning environment.

X. Educational and scientific contribution

Overall the notion of objectivity assumed to be a regulative principle was supported by efforts throughout the paper to demonstrate the complementarity of Constructivist Instruction informed by science and communicative theory.

First, it could offer a causal account of learning. Causal explanations are well suited for explaining general measures of student functioning such as attitude and achievement (Zimmerman, 1986). There are very few causal explanations to be found in Constructivist or self-regulated learning literatures (McCombs & McCombs, 1990). Causal accounts have an explanatory value that could provide a great contribution to the Constructivist literature if fully developed.

Second, it could act as a multi-level explanation, addressing learning at multiple levels where it occurs (physiological, psychological, social). This is an emergent-level perspective in that there are simultaneous levels of learning emerging at the same time with their own respective properties (Bunge, 1979). However, it is also a causal explanation, maintaining the subject-object separation that other accounts (i.e., symbolic interactionism) do not uphold.

Third, CCP could be used as a multi-function explanation, concerned with the necessary flexibility of learning (i.e., learner style, self-efficacy, intention, etc.). It could also include consideration of contextual functioning (i.e., meta-cognitive and cognitive strategic planning, goal-orientation, learner control, etc.).

Fourth, it could be used to uphold the distinction between knowledge structures and processes that underlie individuals' psychological processes and abilities to be self-determined learners within a community of learners. Being able to attend to both knowledge and processes is considered essential to achieving a more complete grasp of Constructivist learning. The strategic integration of these elements offers a philosophical 'mooring' for Constructivist Instructional Theory and Practice .

An objective communicative set of procedures can also address standards of evaluation required for effective instruction. The contribution to be made lies in how it is that standardized evaluative measures essential to instruction are treated. Under this view, problems of evaluation are resolved by Constructivist instructions' prescriptive function. First, evaluations would not simply be administered but would be integrated as part of the learning process. This can be accomplished by making clear who is responsible for creating the evaluative standards and when. This way students can feel they are not merely subjected to some imposed standard, but rather are participating in the standard evaluation. This is done so that students can learn to understand the standard as a first step in being able to participate in the evaluation and selection of future standards. This can be taken to be a type of cognitive apprenticeship (Clancy, 1992; Cobb, 1996; Collins,1991).

Second, learners are participating in standard evaluations administered not with the understanding that the standard is true but rather, is a logical possibility, objectively true for all learning participants and to be worked towards in a cooperative manner (Habermas, 1995; Kagan, 1990). This captures the essence of what Constructivism should encourage when attempting to provide instruction in an educational setting.

Conclusion

The multi-level CCP offered an alternative to the paradox of Constructivist instruction by focusing on recent developments in Cybernetics and communicative theory to get at a depth of

Constructivist learning neglected in contemporary instructional design theory. Support was given to demonstrate that what affects each of us as learners extends beyond our psycho-social processes. The present discussion focused on these underlying elements of learning in demonstrating their potential implications for the development of learning interventions.

Future work will be directed at developing educational interventions that raise the general awareness of the complex set of learning processes and knowledge that arise from individual and collaborate Constructivist instruction. This could be beneficial in promoting self aware and socially responsible learning.

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